

Nassarius (Gastropoda: Neogastropoda) from the Galápagos Islands¹

by

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Abstract. Nine species of *Nassarius* have been reported from the Galápagos Islands, but the occurrence of only six species is substantiated. *Nassarius nodicinctus* (A. Adams) and *N. versicolor* (C. B. Adams) are the two commonly recorded shallow-water species. However, *N. nodicinctus* is the senior synonym of the mainland species *N. angulicostis* (Pilsbry & Lowe), and the name is erroneously applied to the Galápagan species. The distinct species from the Galápagos Islands is described and named *N. caelolineatus*, spec. nov. The first occurrence of one more shallow-water species (*N. shaskyi*) is reported; four deep-water species (*N. townsendi*, *N. exarcus*, *N. goniopleura*, *N. catallus*) are reviewed; and spurious records are discussed.

INTRODUCTION

NINE SPECIES OF *Nassarius* have been reported from Pleistocene and Recent faunas in the Galápagos Islands, Ecuador. Results of a paleontological expedition to the Galápagos Islands in 1982 (LIPPS & HICKMAN, 1982; PITT & JAMES, 1984) included revised age assignments of fossiliferous deposits and new molluscan species, including one *Nassarius* species. With this material at hand, we re-considered the current records of *Nassarius* from the Islands. The most notable feature is that only one shallow-water species (*N. caelolineatus*, spec. nov.) and two of the substantiated deep-water species (*N. townsendi*, *N. exarcus*) are endemic. The others are also distributed along the tropical eastern Pacific coast. Most nassariids, including the deep-water species, have planktotrophic larvae, and, therefore, the potential for wide dispersal. But far fewer *Nassarius* species are on the Islands than on the mainland. Biogeographic affinities of Galápagan nassa-

riids are consistent with the proposal by JAMES (1984) that there is a slower rate of evolution for marine biota than terrestrial biota on the Galápagos Islands.

Acronyms used in the text are as follows: AMNH, American Museum of Natural History; ANSP, Academy of Natural Sciences, Philadelphia; BMNH, British Museum of Natural History; CAS, CASIZ, and CASG, California Academy of Sciences; CDRS, Charles Darwin Research Station, Galápagos Islands; LACM, Los Angeles County Museum of Natural History; MCZ, Museum of Comparative Zoology, Harvard University; UCMP, Museum of Paleontology, University of California, Berkeley; USNM, United States National Museum.

All CAS numbers quoted are station numbers.

TAXONOMY

Family NASSARIIDAE
Genus *Nassarius* Dumeril, 1806

Nassarius caelolineatus Nesbitt & Pitt, spec. nov.

(Figures 1, 2, 17a)

Nassarius nodicinctus A. ADAMS, 1852:110; TOMLIN, 1927: 160; HERTLEIN & STRONG, 1939:373; DEMOND, 1952:

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315; HERTLEIN, 1972:29. [Not *Nassa nodicincta* A. Adams, 1852.]

Alectrion versicolor var. *nodicincta* C. B. Adams: DALL & OCHSNER, 1928:96. [Not *Nassa versicolor* C. B. Adams, 1852; not *Nassa nodicincta* A. Adams, 1852.]

Description of holotype: Protoconch consisting of 4 smooth, bulbous whorls, boundary between protoconch and teleoconch indistinct over $\frac{1}{4}$ whorl; teleoconch consisting of 5 whorls sculptured by axial ribs and spiral lines, whorl profile straight sided, shoulders smooth and angled, noded at posterior end (top) of ribs; sutures wavy; first two teleoconch whorls with numerous axial ribs, third teleoconch whorl with 10 rounded axial ribs, 2 narrow, incised spiral lines crossing axials; penultimate whorl with 10 rounded axial ribs, 4 narrow, incised spiral lines below shoulder nodes, one above shoulder nodes crossing axial ribs; body whorl straight sided with 9 strongly noded axial ridges over entire width of whorl, 9 narrow, incised spiral lines, regularly spaced, one distinct spiral line immediately above node, two spiral traces between that spiral line and suture; fossa filled; anterior canal short, open, notched; aperture ovate, outer lip slightly thickened, non-varicose, weakly lirate within; inner lip bordered by a narrow callus that broadens posteriorly, clearly delimited from parietal surface of body whorl, forming small posterior notch.

Height 11.7 mm, width of body whorl 6.7 mm, aperture height 5.4 mm; protoconch width 0.83 mm.

Type material: Holotype: CASIZ 058038; **paratypes:** CASIZ 058039. In addition 6 paratypes have been sent to each of the following: AMNH, ANSP, BMNH, CDRS, LACM, MCZ, USNM, UCMP.

Type locality: north side of Academy Bay, Isla Santa Cruz, Galápagos Islands (90°18'5"W, 0°44'40"S); coral sand and mud, 5–10 fathoms. Collected by A. G. Smith and J. De Roy, February 1964; CAS 38914.

Etymology: from the Latin *caelo*, meaning "to engrave in bas relief" and *lineatus*, "of a line."

Discussion: *Nassarius caelolineatus*, spec. nov. is a small, slender, turreted *Nassarius*, differing from other Panamic *nassariids* by having regularly spaced, incised spiral lines and a shallow in-filled fossa.

We examined about 1200 specimens of *Nassarius caelolineatus*, both recent and fossil, from the Galápagos Islands, and several hundred specimens of *N. nodicinctus* from the continental coast; the latter were obtained from CAS, LACM and BMNH collections, as well as material borrowed from the private collections of T. Bratcher and D. Shasky. We also examined the type specimens of *N. nodicinctus*, *N. angulicostis*, and *N. versicolor* (C. B. Adams).

The syntypes of *Nassarius nodicinctus* (BMNH 1973154; Figures 3, 4) closely match the holotype of *N. angulicostis* (Pilsbry & Lowe, 1932) (ANSP 155331; Figures 5, 6). A. ADAMS (1852) described *N. nodicinctus* from the Cuming collection (BMNH Accession no. 1829) and there is evidence that the original locality information of "Galá-

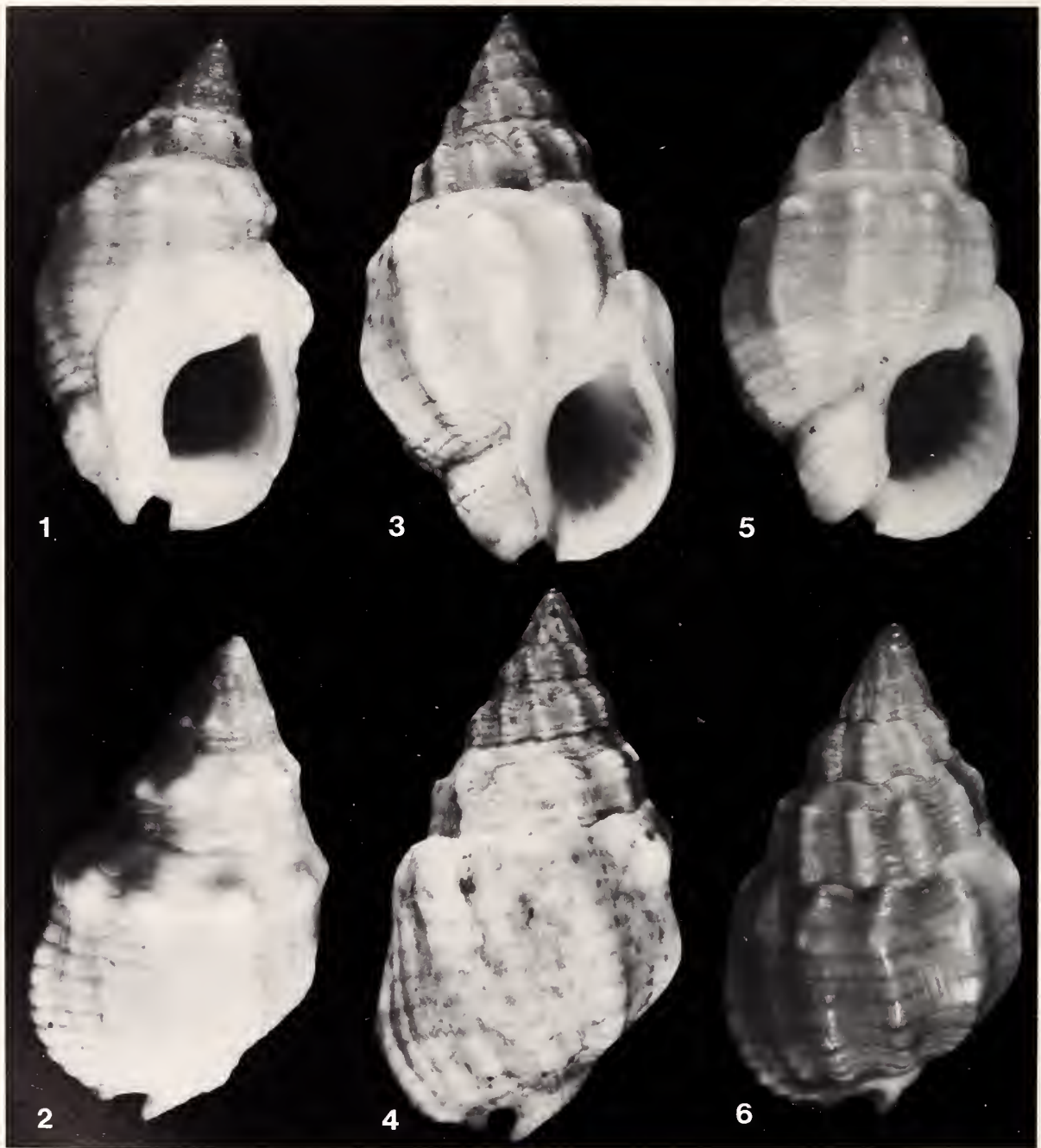
pagos Islands" is incorrect. MARINCOVICH (1977) placed *Polinices galapagosus* (Recluz) in synonymy with *P. otis* (Broderip & Sowerby). He stated (p. 257) that "because *P. (P.) otis* is not known to occur in the Galápagos, the locality data with the syntypes are probably in error." The syntypes of *N. nodicinctus* came from the same Cuming collections as the syntypes of *P. galapagosus* (BMNH Acc. no. 1829), and most probably did not come from the Galápagos Islands. KEEN (1958) described, but did not illustrate, *N. nodicinctus*. KEEN (1971) illustrated types of *N. angulicostis* and *N. nodicinctus* (figs. 1291, 1307), and thus did not include a figured specimen of *N. caelolineatus*.

There is little intraspecific variation in either *Nassarius caelolineatus* or *N. nodicinctus* compared to other eastern Pacific *Nassarius* species (Nesbitt, in prep.). Size ranges of adult specimens (minimum of 8 whorls) are height 10.8 to 16.1 mm, width of body whorl 5.8 to 15.9 mm, and aperture height 4.9 to 6.2 mm. The protoconch diameter divided by the number of protoconch volutions is an indicator of larval mode of life in gastropods (SHUTO, 1974). For *N. caelolineatus* this index is 0.2, which falls within the range of planktotrophic larval types. The color pattern is pale yellow to mottled red-brown. The distinct periostracum forms a reticulate pattern of thickening along the spiral grooves and between the axial ribs.

This species occurs throughout the Galápagos Islands to a depth of 70 m. Fossils occur in late Pliocene/early Pleistocene deposits on Isla Baltra (CASG 61388), Pleistocene deposits on Isla Santa Cruz (CASG 61225, 61234, 61236) and Isla Isabela (CASG 61229), and Quaternary indurated beach sands on Isla Isabela (CASG 61399) (DALL & OCHSNER, 1928; HERTLEIN & STRONG, 1939; HERTLEIN, 1972; PITT *et al.*, in press).

Radulae were prepared for light microscopy, and one isolated central and lateral tooth from a paratype are illustrated (Figure 17b). The radula is similar to the common radula pattern of most eastern Pacific *nassariids*, and is adapted basically for an unspecialized scavenging habit (Nesbitt, in prep.). The lateral tooth has 3 to 5 subcusps medially, variation frequently occurring on the same radula ribbon. There are 14 cusps on the central tooth.

Compared to *Nassarius caelolineatus*, the syntypes of *N. nodicinctus* and the holotype of *N. angulicostis* are more robust, with narrow, brown, spiral lines that are not incised, less tabulate shoulders, with poorly developed nodes, a broader posterior region of the callus, and a deep fossa. Only *N. caelolineatus* and *N. versicolor* (C. B. Adams) are recorded from the Galápagos Islands. *Nassarius versicolor* differs from *N. caelolineatus* by having closely spaced, fine spiral ridges on the early whorls, a variable number of irregularly spaced incised spiral lines on the body whorl, less pronounced nodes, a shallower fossa, and a narrower callus. Based on shell and radular features, *N. caelolineatus* is the sister group of *N. versicolor* and not *N. nodicinctus*. It has been found only in the Galápagos Islands and apparently originated there.



Explanation of Figures 1 to 6

Figures 1 and 2. Holotype of *Nassarius caelolineatus*, spec. nov., CASIZ 058038 (height 11.7 mm).

Figures 3 and 4. Lectotype of *Nassarius nodicinctus* (A. Adams), BMNH 1973154/1 (height 16.1 mm).

Figures 5 and 6. Holotype of *Nassarius angulicostis* (Pilsbry & Lowe), ANSP 155331 (height 12.9 mm).

Nassarius nodicinctus (A. Adams, 1852)

(Figures 3–6, 17b)

Nassa nodicincta A. ADAMS, 1852:110.*Nassarius nodicinctus*: KEEN, 1958:410, 1971:607, fig. 1307; CERNOHORSKY, 1975:128–129, figs. 20–24.*Alectrion nodicinctus*: DALL, 1917:576 (in part).*Nassa angulicostis*: PILSBRY & LOWE, 1932:69, pl. 6, fig. 2.*Nassarius angulicostis*: KEEN, 1958:408, fig. 568, 1971:604, fig. 1291.

Based on a study of type specimens, CERNOHORSKY (1975) synonymized *Nassarius angulicostis* with *N. nodicinctus*. This species ranges from Gulf of California to Ecuador (SHASKY, 1984), and is not known to occur in the Galápagos Islands. The species from the Galápagos Islands that was erroneously called *N. nodicinctus* is herein named *N. caelolineatus*. *Nassarius nodicinctus* is characterized by numerous thin, brown, spiral lines on the body whorl, a deep fossa, and well developed axial ribs extending the entire length of the body whorl. We have selected a lectotype, BMNH 1973154/1 (Figures 3, 4), and paralectotype, BMNH 1973154/2, from A. Adams' syntypes.

The radula of *Nassarius nodicinctus* (Figure 17b; CASIZ 058031) is notably different from those of other Panamic species of *Nassarius* (Nesbitt, in prep.). The subcusps on the central tooth are partially fused, and there is an indication of extra thickening of the radula ribbon around the medial edge of each lateral tooth, which is in the position of the accessory plate in some western Pacific species, e.g., *N. conoidalis* (Deshayes & Belanger) from Kao Hsuing, Taiwan (CASIZ 058032) (Nesbitt, in prep.).

This species shows little variation of shell shape and ornamentation, compared with other eastern Pacific species of *Nassarius* (Nesbitt, in prep.). The protoconch, of 3 smooth bulbous whorls, has a diameter/volution ratio of 0.25, which is within the range inferring a planktotrophic larval type (SHUTO, 1974). The species ranges from the intertidal zone to a depth of 40 m, and has not been found in the fossil record.

Nassarius versicolor (C. B. Adams, 1852)

(Figures 7, 8, 17c)

Nassa versicolor C. B. ADAMS, 1852:290–291; TURNER, 1956: 97–98, pl. 6, fig. 8 (figured lectotype).*Nassa (Hima) versicolor*: TRYON, 1882:50, 51, pl. 15, figs. 270–272, 275.*Nassarius versicolor*: TOMLIN, 1927:161, 1932:43, 95; GRANT & GALE, 1931:677; HERTLEIN & STRONG, 1939:370; DEMOND, 1952:310, 312, pl. 1, fig. 5; KEEN, 1958:412, fig. 587, 1971:609, fig. 1314.*Alectrion versicolor*: DALL, 1917:576.*Nassa versicolor* var. *striatula* C. B. ADAMS, 1852:290; TURNER, 1956:98.*Nassa glauca* C. B. ADAMS, 1852:285–286.*Nassa proxima* C. B. ADAMS, 1852:288–289.*Nassa striata* C. B. ADAMS, 1852:289–290.*Nassa crebristriata* CARPENTER, 1857:499; KEEN, 1968:426, pl. 58, fig. 60.*Alectrion crebristriata*: DALL, 1917:577.*Nassa rufocincta* A. ADAMS, 1852:106.*Nassa albipunctata* REEVE, 1855:pl. 21, no. 144.

The numerous synonyms indicate variability in shell morphology of this widespread and common species. TRYON (1882) synonymized C. B. Adams' species, *Nassarius glauca*, *N. proxima* and *N. striata* with *N. versicolor*. TURNER (1956) illustrated C. B. Adams' type specimens and these show the range of shell shapes and ornamentation. Most of Adams' types are from single specimens or small lots, and all were collected around the island of Taboga, Panama Bay, Panama. The original description of *N. versicolor*, quoted below, requires some addition.

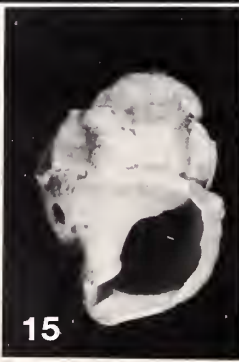
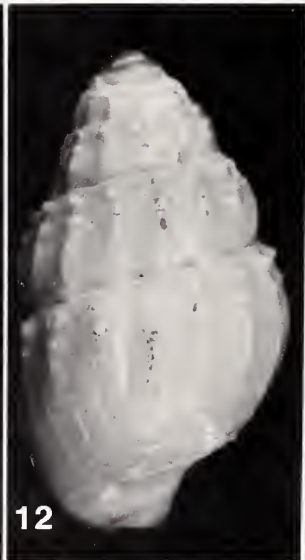
“Shell long ovate conic: pale yellowish brown, or nearly white, with a darker sutural line, or blackish brown: sometimes the ends of summits of the ribs are whiter than the interspaces; sometimes the sutural fascia covers the anterior part of the last whorl: with, on each whorl, nine or ten narrow very prominent ribs; with very minute spiral striae, which are nearly obsolete on the middle of the whorls; spire with the outlines nearly or quite rectilinear: apex acute; whorls eight, slightly convex, with a well impressed suture; last whorl spirally canaliculate anteriorly: aperture subelliptical: labrum subacute, thickened with a stout varix: labrium thickened, not appressed, finely wrinkled: notch deep. Var. *striatula* is covered with very distinct striae.

Mean divergence about 45°; length .6 inch; breadth .33 inch; length of spire .35 inch” (C. B. ADAMS, 1852).

Additional description: (1) 8–11 axial ribs, across entire length of body whorl, ranging from poorly developed to subnodal on shoulders. (2) Numerous, closely packed, minute, spiral striae on early postnuclear whorls, with little intraspecific variation; from third post-nuclear whorl a wide range of spiral ornamentation, varying from whorls being completely covered in minute incised striae (the “*striatula*” and “*proxima*” forms) to very few, poorly developed striae on body whorl (“*glauca*” form). The majority of specimens studied have unevenly developed and unevenly spaced incised spiral lines on the penultimate and body whorls. (3) Profile varies from globose to slender and high spired (“*proxima*” form).

Nassa rufocincta A. Adams and *Nassa albipunctata* Reeve are based on single specimens, synonymized with *Nassarius versicolor* by TOMLIN (1932), and figured by CERNOHORSKY (1975). *Nassa crebristriata* Carpenter was first synonymized with *Nassarius versicolor* by KEEN (1968). We studied the type specimens of all these species and concur.

The radula of *Nassarius versicolor* (Figure 17c; CASIZ 058033) is typical of most nassariids, and has a variable number of subcusps medially on the lateral tooth, with 9 or 10 cusps on the central tooth.



Distribution: Living from Magdalena Bay, Baja California, and the Gulf of California, Mexico, to south of Paita, Peru. Pleistocene fossils from Isla San Salvador, Galápagos Islands (CAS 27255; HERTLEIN & STRONG, 1939), and a single specimen from Quaternary indurated beach sands, Isla Isabella (CASG 61399).

Lectotype: MCZ 177145.

Nassarius exsarcus (Dall, 1908)

(Figures 9, 10)

Alectrion (Tritia) exsarcus DALL, 1908:308, fig. 12.

Nassarius exsarcus: KEEN, 1971:606, fig. 1297; CERNOHORSKY, 1975:146, fig. 52.

Nassarius exsarcus was described from a specimen dredged from the *Albatross* off the Galápagos Islands, at a depth of 300 fathoms (549 m) (CERNOHORSKY, 1975), not 200 fathoms as recorded by Dall. Specimens have also been dredged by A. & J. De Roy off Isla Pinzon (Duncan Island) from 366 m (LACM 105307).

This species is high spired and turreted with prominent axial ribs and a narrow, well defined callus. The most distinguishing feature is a large globose, porcelaneous protoconch, consisting of 5 smooth whorls. The first three whorls have a flattened conical profile, whereas the most anterior two are more globose. There is a distinct spiral keel on the anterior half of each whorl. The whorl diameter/volution index is 0.37, suggesting that the larvae are most probably planktotrophic.

Holotype: USNM 110565.

Nassarius townsendi (Dall, 1890)

(Figures 11, 12)

Nassa townsendi DALL, 1890:326, pl. 12, fig. 9.

Nassarius townsendi: KEEN, 1971:608, fig. 1313a; CERNOHORSKY, 1975:146-147, fig. 54.

The only record of this species is the holotype, which was dredged off the *Albatross* from 1486 m. CERNOHORSKY (1975) mentioned the similarity of this species and *Nassarius babylonica* (Watson, 1882) (Figures 13, 14), a somewhat more common deep-water species from the western Pacific and Indian Oceans (SALISBURY, 1984; CER-

NOHORSKY, 1978). However, *N. babylonica* is distinguished by distinctly tabulate shoulders and a straight-sided whorl profile. The two species may be closely related, but with so few specimens it is not possible to come to any reliable conclusions.

Nassarius townsendi is characterized by a small ovoid shell with comparatively rounded whorl profile, 15 axial ridges on the upper half of the body whorl, and a narrow, well delimited callus. The protoconch, consisting of 4 smooth bulbous whorls, is large and low spired, and the diameter/volution index is 0.3, within the range for a planktotrophic larval mode (SHUTO, 1974).

Holotype: USNM 96473.

Nassarius goniopleura (Dall, 1908)

(Figures 15, 16)

Alectrion (Tritia) goniopleura DALL, 1908:308-309.

Nassarius goniopleura: KEEN, 1971:606, fig. 1301.

This species was described from a single, damaged specimen, dredged by the *Albatross* at 1194 m, off the Galápagos Islands. The sculpturing on the body whorl, the only part preserved, is distinct and unlike any other known *Nassarius* species from the Pacific. However, no other specimen has been recorded, and it cannot be substantiated as a Galápaguan species.

Holotype: USNM 110630.

Nassarius catallus (Dall, 1908)

Nassa hanleyana MARRAT, 1880:75, 83; TOMLIN, 1940:36

(not *Buccinum hanleyanum* Dunker, 1847 = *Nassarius*).

Alectrion (Hima) catallus DALL, 1908:307, pl. 11, fig. 11.

Alectrion catallus: DALL, 1917:576.

Alectrion polistes DALL, 1917:577.

Nassarius catallus: STRONG, 1945:4; DEMOND, 1952:312, fig. 8; KEEN, 1958:408, fig. 569; ADDICOTT, 1965:B11; KEEN, 1971:606, fig. 1292; CERNOHORSKY, 1975:126, figs. 12-19.

CERNOHORSKY (1975) figured the holotype of *Nassarius catallus*, and the types of *N. polistes* and *N. hanleyana* (a secondary homonym of *Buccinum hanleyanum* Dunker, *vide* CERNOHORSKY [1975]). *Nassarius catallus* is characterized by a strong, smoothly reticulate ornamentation and nar-

Explanation of Figures 7 to 16

Figures 7 and 8. Lectotype of *Nassarius versicolor* (C. B. Adams), MCZ 177145 (height 14.4 mm).

Figures 9 and 10. Holotype of *Nassarius exsarcus* (Dall), USNM 110565 (height 9.0 mm).

Figures 11 and 12. Holotype of *Nassarius townsendi* (Dall), USNM 96473 (height 10.5 mm).

Figures 13 and 14. A syntype of *Nassarius babylonica* (Watson), BMNH 1887.2.9.6-8 (height 11.0 mm).

Figures 15 and 16. Holotype of *Nassarius goniopleura* (Dall), USNM 110630 (height 5.5 mm).

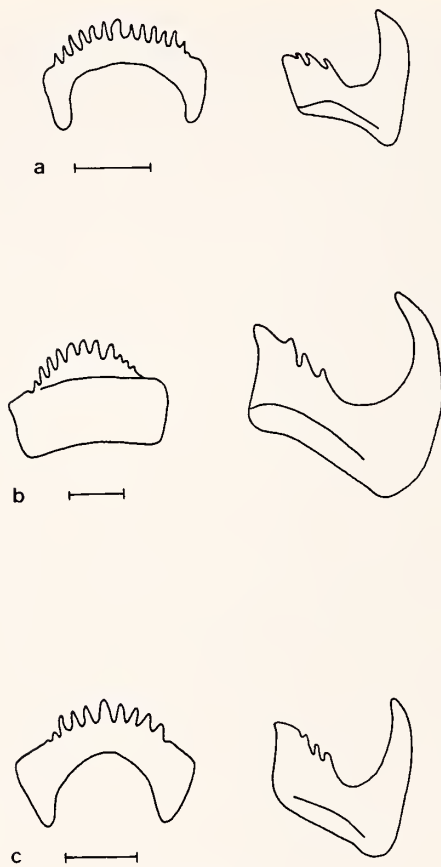


Figure 17

One lateral and one central tooth from the radula of: a, *Nassarius caelolineatus*, spec. nov., paratype, CASIZ 058039, Galápagos Islands; b, *N. nodicinctus* (A. Adams), CASIZ 058031, Guaymas, Mexico; and c, *N. versicolor* (C. B. Adams), CASIZ 058033, Sonora, Mexico. Scale = 0.1 mm.

row, well developed parietal callus. It is a rare, deep-water inhabitant, reported from Baja California to Peru, with one confirmed lot dredged from 180–280 m off Isla Wolf, Galápagos Islands (LACM AHF143-35).

Holotype: USNM 123013.

Nassarius shaskyi McLean, 1970

Nassarius shaskyi McLEAN, 1970:128–129, fig. 41; KEEN, 1971:606, fig. 1312.

Nassarius shaskyi is characterized by obsolete spiral sculpture, and, on the body whorl, pronounced apical nodes on concave axial ridges, and a well defined callus. It is a rare, shallow-water species with a widespread distribution from the outer coast of Baja California, and from the Gulf of California to Colombia. In addition, McLean (personal communication, 1984) collected one adult specimen from 23 to 30 m off Isla Wolf, Galápagos Islands in May 1984.

Holotype: LACM 1405.

Spurious Records of *Nassarius* Species from the Galápagos Islands

Nassarius anguliferus and *N. pagodus*: *Nassarius anguliferus* (A. Adams, 1852) was described from the Cuming collection. The locality was stated to be the Galápagos Islands, and this was repeated by REEVE (1853:34), CARPENTER (1857:361), STEARNS (1853:406), and PILSBRY & VANATTA (1902:554). The erroneous locality record probably has the same source as that for the type specimens of *N. nodicinctus* and *Polinices galapagosus*. We cannot locate the specimens reported by PILSBRY & VANATTA (1902) to be in the Stanford University collection, but other specimens labeled *N. anguliferus* from early CAS and Stanford collections are *N. nodicinctus* (as described herein).

TRYON (1882:45) stated that *Nassarius anguliferus* is a juvenile specimen of the common and variable Panamic species *N. pagodus* (Reeve). Comparisons with the type specimens, and with a large size range of *N. pagodus* specimens from the Gulf of California to Ecuador, confirm this. Thus, the spurious account of *N. pagodus* from the Galápagos is the result of Tryon's synonymy. TOMLIN'S (1932) synonymy of *N. anguliferus* with the Mediterranean species *N. migra* (Bruguière) and KEEN'S (1971) with *N. dentifer* (Powys) from the Peruvian Province are therefore incorrect.

Nassarius nodifera: POWYS (1835) described *Nassa nodifera* from the Cuming collection, with the locality records "Galápagos Islands and beaches of Panama." This locality information was copied by REEVE (1853:23), CARPENTER (1857:361), STEARNS (1893:406), and KEEN (1958:410). TRYON (1882:28) synonymized the species with *N. hirtus* (Kiener), and stated that the "localities of 'Panama and Galápagos' are almost certainly incorrect." This species is common in the western Pacific and the Indian Ocean, and has not been recorded subsequently from the Galápagos Islands.

Nassarius tegula: SMITH (1940) stated that *N. tegula* (Reeve) occurs along the western tropical mainland and the Galápagos Islands. This species is a southern geographic subspecies of *N. tiarula* (Kiener) which has only been recorded from California to Panama.

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